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Diag. Cht. No. 9000-4.

FORM C&GS-504

U.S. DEPARTMENT OF COMMERCE  
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION  
COAST AND GEODETIC SURVEY

## DESCRIPTIVE REPORT

Type of Survey Hydrographic  
Field No. PI-454-65 Office No. H-8857, H-8858 & H-8863 thru H-8869

### LOCALITY

State.....  
General locality Pacific Ocean  
Locality Coast of California to longitude  
133° W - latitude 35°N to 39°N.

1965

CHIEF OF PARTY

Capt. H. S. Cole

LIBRARY & ARCHIVES

DATE Nov. 23, 1965

USCOMM-DC 3,022-P66

Surveys not to be verified or reviewed  
12/16/65

8869

THRU

8863

HYDROGRAPHIC TITLE SHEET

H-8857

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PI-454-65  
1407 N-B

State \_\_\_\_\_

General locality Pacific Ocean

Locality near coast of California

Scale of OSS # 13 Date of survey July- October 65

Instructions dated December 23, 64 Project No. OPR 454

Vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole \_\_\_\_\_

Graphic record scaled by Johnson, Williams, Sessions, Lichty, and Kadoto

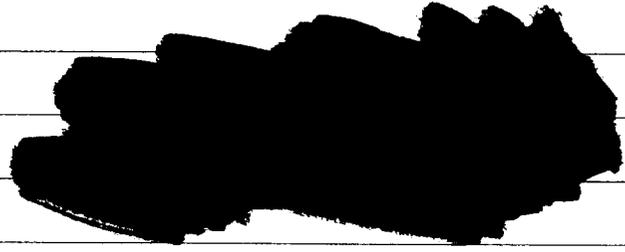
Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Johnson

Soundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_



*Applied to Standards*

HYDROGRAPHIC TITLE SHEET

H-8858

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PT-454-65  
1307 N-A

State \_\_\_\_\_

General locality Pacific Ocean

Locality near coast of California

Scale of OSS # 13 Date of survey July- October 65

Instructions dated 12-23-64 Project No. OPR 454

Vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole

Graphic record scaled by ~~same as 'Surveyed by'~~ Johnsen, Williams, Sessions, Lichty, and Kadoto

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Johnsen and Rogers

oundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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HYDROGRAPHIC TITLE SHEET

H-8863

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PI-454-65  
1407 N-C

State \_\_\_\_\_

General locality Pacific Ocean

Locality near coast of California

Scale of OSS # 12 Date of survey July-October 65

Instructions dated 12-23-64 Project No. OPR 454

Vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Schinke and Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole \_\_\_\_\_

Graphic record scaled by Johnsen, Williams, Sessoms, Lichty, Kadoto, Marquard, Lundquist, and Dodson

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Lichty, Johnsen, and Lance

oundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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HYDROGRAPHIC TITLE SHEET

H-8864

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PI-454-65  
1307 N-D

State \_\_\_\_\_

General locality Pacific Ocean

Locality near coast of California

Scale of OSS # 12 Date of survey July- October 65

Instructions dated 12-23-64 Project No. OPR 454

vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Schimke and Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole \_\_\_\_\_

Graphic record scaled by Johnsen, Williams, Sessoms, Lichty, Kadoto, Marquard, Lundquist, and Dodson

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Johnsen

oundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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**HYDROGRAPHIC TITLE SHEET**

H-8865

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PT-454-65  
1406 N-B

State \_\_\_\_\_

General locality Pacific Ocean

Locality near coast of California

Scale of OSS # 11 Date of survey July- October 65

Instructions dated 12-23164 Project No. OPR 454

Vessel Pioneer

Chief of party Captain H.S.Cole

Surveyed by LTJG Schimke and Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole \_\_\_\_\_

Graphic record scaled by Johnsen, Williams, Sessoms, Lichty, Kadoto, Marquard, Lundquist, and Dodson

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Yorkman and Lance

Soundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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HYDROGRAPHIC TITLE SHEET

H-8866

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PI-454-65  
1306 N-A

State \_\_\_\_\_

General locality Pacific Ocean

Locality near coast of California

Scale of OSS # 11 Date of survey July- October 65

Instructions dated 12-23-64 Project No. OPR 454

Vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Schimke and Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole \_\_\_\_\_

Graphic record scaled by Johnsen, Williams, Sessoms, Lighty, Marquard, Lundquist, and Dodson

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Mc Carthy and Lance

oundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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HYDROGRAPHIC TITLE SHEET

H-8867

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PI-454-65  
1307 N-B

State \_\_\_\_\_

General locality Pacific Ocean

Locality along coast of California

Scale of OSS # 13 Date of survey July- October 65

Instructions dated 12-23-64 Project No. OPR 454

vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole

Graphic record scaled by Johnsen, Williams, Sessoms, Lichty, and Kadoto

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Mc Carthy and Lichty

oundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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HYDROGRAPHIC TITLE SHEET

H-8868

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PI-454-65  
1306 N-B

State \_\_\_\_\_

General locality Pacific Ocean

Locality along coast of California

Scale of OSS # 11 Date of survey July- October 65

Instructions dated 12-23-64 Project No. OPR 454

Vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Schimke and Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole

Graphic record scaled by Johnsen, Williams, Sessoms, Lichty, Kadota, Marquard, Lundquist, and Dodson

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Yerkman and Lance

oundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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HYDROGRAPHIC TITLE SHEET

H-8869

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO. PI-454-65  
1307 N-C

State \_\_\_\_\_

General locality Pacific Ocean

Locality along coast of California

Scale of OSS # 12 Date of survey July-October 65

Instructions dated 12-23-64 Project No. OPR 454

Vessel Pioneer

Chief of party Captain H.S. Cole

Surveyed by LTJG Schimke and Hough; Ens. Paulsen, Edwards, Ensign, Kenny, Tabbone, Scygiel, and Noble

Soundings taken by echo sounder, hand lead, pole

Graphic record scaled by Johnsen, Williams, Sessoms, Lichty, Kadota, Marquard, Lundquist, and Dodson

Graphic record checked by same as 'Surveyed by'

Protracted by same as 'Surveyed by'

Soundings penciled by Johnsen, Lance, ~~KM~~ Kadota, and Lichty

oundings in fathoms feet at MLW MLLW \_\_\_\_\_

REMARKS: \_\_\_\_\_

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A. PROJECT

Phase I of OPR-454 (Upper Mantle Project) was an oceanographic trackline survey, consisting of E-W lines of soundings, gravity, and magnetics run at 10-mile spacing, with an appropriate system of crosslines.

Instructions for the above were dated November 5, 24, and 30, 1964; December 23, 1964; and April 28, 1965.

B. AREA SURVEYED

The area surveyed is between latitudes 35° N and 39° N; extending from the coast of California to longitude 133° W. The inshore limit of the survey was the approximate 20-fathom curve; however, most east-west lines were terminated before the 20-fathom curve was reached, from the consideration of ship's safety.

The above area had been partially covered by several previous surveys. In 1929, two 1:80,000 sheets were obtained, of registry numbers H-4980a and H-4981; two 1:120,000 sheets numbered 4992 and H-5014; and a 1:40,000 sheet numbered 4987. A 1:20,000 scale sheet was made in 1932, and a 1:80,000 in 1932-1934, with respective registry numbers H-5472 and H-5473. An extensive survey was made in 1955-1956, all on 1:200,000 sheets. These sheets have no registry numbers, only field numbers, which are the following: 20-10-55; 20-11-55; 20-12-55; 20-13-55; 20-14-55; 20-15-55; 20-16-55; and 20-1-56.

*2 Classified  
sheets  
made for  
NOO*

C. SOUNDING VESSEL

All soundings were obtained from the USC&GSS Pioneer, OSS-31, under the command of Captain Howard S. Cole.

D-a. SOUNDING EQUIPMENT

Four echo sounders were employed in this survey: Two Precision Depth Recorders, Mark XV-A, of serial numbers 309 and 322; and two Raytheon Survey Fathometers, Model DE-723, of serial numbers 264 and 933.

In depths of over 100 fathoms, the Precision Depth Recorders were used, and a standard two-fathom draft correction was adopted.

Under 100 fathoms, during most of the survey, both a PDR on the 600-foot scale, and a Raytheon fathometer were operated simultaneously. The draft corrections, rounded to the nearest 0.2 fathom, were based on observations, and therefore differ somewhat throughout the project, depending on the status of the fuel and water tanks. An occasional increase in the draft correction without any fuel intake may seem erroneous; however, fresh water accumulated from evaporation, and water or fuel transferred from the after to the forward tanks, can easily account for such trend.

No bar checks were taken, but the PDR's were periodically checked for phase and time. Periodic checks on the general sounding accuracy were obtained by comparing depth measurements on line crossings.

#### D-b. GRAVITY EQUIPMENT

The La Coste and Romberg S-11 gravity meter was used for the entire project. To monitor the accuracy of results, periodic comparisons of gravity values were made on line crossings, and land ties were made in port with the Worden gravity meter before and after each trip. A moderate amount of drift was indicated by these comparisons.

It was occasionally necessary to secure the gravity meter on account of rough weather, especially in case of beam seas. There had been only one breakdown, due to the malfunction of a tube in the voltage regulator. Since no replacement was available for the regulator, it was bypassed, and direct line voltage was installed.

Gravity observations were reduced and computed at four-hourly intervals, on a day-to-day basis. The automatic endoder system was functioning satisfactorily, thus no continuous gravity watches were necessary.

#### D-c. MAGNETIC EQUIPMENT

To measure and record magnetic intensity, a Varian Proton Magnetometer, Model V-4931, was used, of serial number 21. The equipment produced good results. There was a single breakdown resulting from a defective Joy plug, which caused the loss of some data, but was soon rectified.

Periodically, values of magnetic intensity were compared on line crossings as a check on the accuracy of the instrument. These values generally indicated a good agreement, with the necessary allowance for daily variations and occasional magnetic storms.

The rate of triggering was one cycle per minute. No shipboard processing was done on magnetic records. Both magnetic and gravity data were simultaneously recorded by an automatic punch tape system.

#### E. SMOOTH SHEETS

Nine paper OS Sheets were used in this survey. A separate sketch shows the sheet layout. The sheets were laid out, and numbered, in accordance with the BC Index system.

A set of mylar sheets were used for boat sheets. Throughout the project, the boat-smooth sheet method was employed, with very satisfactory results, and considerable saving in time. In case of doubtful positions, the final plot was made in the processing office. Land ties were plotted on charts, then transferred to the corresponding boat sheets.

#### F. CONTROL

Satellite navigation was used as primary control in this project. In addition, Loran A and astronomic observations were made. Land ties were based on visual and radar fixes.

For the most part, the satellite system operated satisfactorily. In smooth plotting, considerable weight was given to satellite fixes. Occasional fixes were lost, due to instrumental malfunctions or errors made by operators.

During part of B-day, difficulties were experienced for about two days, resulting in the loss of satisfactory control. After some investigation the source of the trouble was found to be a defective light bulb in the computer program-tape reader head.

The accuracy of Loran A rates was good in some areas, relatively poor in others. Good reception was obtained mostly near the stations, as could be expected. Occasional consistent errors in Loran occurred at certain locations, and were monitored by comparison to satellite control.

In clear weather, sun and star observations were made regularly. Star fixes were plotted on overlays, then transferred to the boat sheet directly. Most of the star fixes taken during B and C days were consistent, with the individual lines showing good agreement within themselves. Star fixes of A-day were somewhat less reliable.

Several land ties were made on radar alone, due to dense fog near the coastline. Others were made both by radar and by visual methods. With very few exceptions, the ties showed a good agreement with the DR positions derived from previous control. In good weather, while running east-west lines, a tie was made approximately once every three days. This afforded an excellent opportunity of checking navigational control.

#### G. SHORELINE

No shoreline appears on the sheets. An approximate 25-fathom curve was plotted on the boat sheets, however, primarily for the purpose of safety. This curve was obtained from C&GS charts.

#### H. CROSSLINES

2,262 miles of true N-S crosslines were run, or 17.1 per cent of the project. In addition, a few short diagonal crosslines were run for the purpose of getting into position to start new sounding lines. These were not counted in the above calculation.

All crossings were carefully examined, making use of the fathograms every time. The crossings showed a remarkably good agreement, indicating a high degree of accuracy throughout the entire project. Many soundings checked out exactly; others varied only slightly. When considering the terrain, however, these variations could be resolved by a small relative error in position, up to, but not exceeding, a mile.

#### I. JUNCTIONS

Several prior surveys partially cover the area of this project. See the following paragraph for comparison.

#### J. COMPARISON WITH PRIOR SURVEYS

Comparison was made with all surveys listed in Paragraph B. When no registry number is available, sheets are referred to by field numbers.

The following sheets show a good agreement with the survey: H-5472; H-5473; H-4980a; 4992; H-5014; 20-10-55; 20-11-55; 20-12-55; 20-13-55; 20-16-55; and 20-1-56.

The agreement is excellent in the case of 4987 and H-4993. H-4981, 20-14-55, and 20-15-55 indicate only reasonably good agreement. In case of the last, discrepancies were found at  $38^{\circ} 30' N$ ,  $127^{\circ} 30' W$ , where the observed sounding was 60 fathoms deeper; and at  $38^{\circ} 30' N$ ,  $128^{\circ} 10' W$ , with the observed sounding 70 fathoms shoaler than that of the prior survey. In addition, the seamount indicated by the former survey at  $38^{\circ} 30' N$ ,  $128^{\circ} 20' W$  was not found.

#### K. COMPARISON WITH CHARTS

A comparison was made with charts of the available largest scale. C&GS Charts 5302, 5402, 5403, 5502, 5520, and 5598 indicated a good agreement with the survey.

In case of chart 5002, numerous and alarming discrepancies were found. The observed soundings were 100 fathoms deeper than the charted ones at the following positions:  $38^{\circ} 41' N$ ,  $126^{\circ} 00' W$ ;  $37^{\circ} 47' N$ ,  $126^{\circ} 08' W$ ; and  $37^{\circ} 49' N$ ,  $126^{\circ} 49' W$ . Depths 200 fathoms greater than the charted soundings were observed at:  $38^{\circ} 58' N$ ,  $128^{\circ} 16' W$ ;  $38^{\circ} 38' N$ ,  $132^{\circ} 45' W$ ;  $35^{\circ} 09' N$ ,  $127^{\circ} 45' W$ ;  $36^{\circ} 50' N$ ,  $132^{\circ} 38' W$ ; and at  $36^{\circ} 50' N$ ,  $132^{\circ} 15' W$ . At position  $37^{\circ} 11' N$ ,  $128^{\circ} 45' W$ , the observed sounding was 150 fathoms deeper; and at  $35^{\circ} 40.5' N$ ,  $132^{\circ} 40' W$ , it was 350 fathoms deeper than the corresponding charted soundings.

New least soundings were found at  $35^{\circ} 10' N$ ,  $128^{\circ} 11' W$  and at  $37^{\circ} 28.5' N$ ,  $126^{\circ} 13.5' W$ , shoaler than the charted depths by 140 and 250 fathoms, respectively. A 2220-fathom sounding, representing a 400-fathom rise, was detected at  $36^{\circ} 08' N$ ,  $127^{\circ} 05' W$ . In addition, new seamounts were discovered at  $39^{\circ} 31' N$ ,  $132^{\circ} 16' W$ , and at  $39^{\circ} 01' N$ ,  $131^{\circ} 02' W$ . The former has the relative rise of 500 fathoms, and the latter, of 900 fathoms. Further investigation of these mounts may reveal even more prominent rises.

At position  $38^{\circ} 39' N$ ,  $127^{\circ} 14' W$ , a sounding of 2490 fathoms was measured. No trace of the seamount, which is shown on the chart with a peak of 1604 fathoms, was found in this location.

#### L. ADEQUACY OF SURVEY

The survey is complete and adequate. It is more accurate than most previous surveys of the area, since satellite navigation, not available until recently, was used for primary control. In case of the coastwise sections, however, former launch work based on carefully established visual signals, or surveys made on shore control, are undoubtedly more satisfactory than this project.

The survey contains no incomplete or substandard parts, with the exception of a few short splits.

#### M. AIDS TO NAVIGATION

No aids to navigation were located, since this project was primarily a deep sea survey, and the coastline was approached only occasionally.

## N. STATISTICS

During the 58 days spent at sea, 16,615 miles of soundings, 16,409 miles of magnetics, and 13,231 miles of gravity were run. Although gravity mileage is 80 per cent of the sounding mileage, it should be noted that weather sufficiently smooth for gravity observations was only 68 per cent of the total sea-days. In case of rough seas, speed was invariably reduced to improve the quality of soundings. In accordance with the instructions, an effort was made to extend gravity coverage so that no two adjacent lines would be without gravity. This effort was successful for the most part; because of the unpredictability of weather conditions, however, it was impossible to provide gravity for several adjacent line segments.

The number of positions established was 2,341, and the approximate number of square miles covered by hydrography is 110,800.

## O. MISCELLANEOUS

Information concerning the two newly found seamounts has already been given earlier. It should also be noted that the section of the project area west of the 128th meridian was found to be quite rugged, containing, in addition to a few seamounts, many steep faults, ridges, sudden rises, and abrupt depressions, which made sounding and contouring rather difficult, often necessitating a reduction in speed.

## P. RECOMMENDATIONS

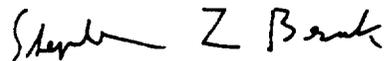
The sounding lines run show a good regularity. On sheet 1307 N-D, splits could be run at three different sections, the combined length of which would amount to a total of about 140 miles. Additional investigation of the two uncharted seamounts is recommended, as well as further development of the northwest corner of the project area, north of latitude  $37^{\circ} 45' N$ , and west of longitude  $128^{\circ} W$ , which appears to be especially interesting topographically.

Since east-west GEP lines will be run in the near future, at 60-mile spacing, it is suggested that these be run between, rather than over, the already completed tracklines, in order to avoid duplication of sounding data and gain additional information.

## Q. REFERENCES TO REPORTS

In addition to this report, the following records are necessary for a complete understanding of OPR-454, Phase I: Nine mylar boat sheets, nine smooth sheets, and all A, B, and C-day sounding volumes, fathograms, DR-abstracts, Loran A computations, satellite printout tapes, satellite computations, astronomic computation sheets, navigational data forms, and magnetic and gravity information consisting of graphs, tapes, computations, and combined punch tapes. The above have already been, or are in the process of being forwarded to, the Washington Office.

Respectfully submitted,



Stephen Z. Bezuk, Lt.  
Operations Officer, USC&GSS PIONEER

APPROVAL SHEET

The sheets and records of this survey have been examined and approved.

The survey is complete and accurate within the limits of available control and equipment.



Captain Howard S. Cole  
Commanding Officer, USC&GSS PIONEER

## TIDE NOTE

Tide reducers were applied throughout the survey for all soundings under 100 fathoms. The corrections were based on observations, obtained from the Marine Data Division, for the appropriate times and locations. From sheets listing the heights of tide, graphs were prepared, and reducers established.

## CORRECTIONS TO ECHO SOUNDINGS

For use in this project, a group of three sound-velocity correction tables were received from the Seattle Regional Officer, accompanied by a letter dated July 16, 1965. The tables were numbered I, II, and III.

Table I was for the area between the California coast and longitude 130°W; Table II, between longitudes 130°W and 160°W when north of latitude 38° 53'N; and Table III, between longitudes 130°W and 160°W when south of latitude 38° 53'N. Since the northern limit of the project area was latitude 39° 00'N, and lines were run at ten-mile spacing, Table II would have only applied to a single line segment 144 miles long, or less than one per cent of the entire project. Table II was therefore rejected, and only Tables I and III were used, for east and west of longitude 130°W, respectively.

Since Table I terminated at 2000 fathoms, and some sections of the project area were as deep as 2800 fathoms, it was necessary to extend this table. The extension was done by graphically superimposing the deep section of Table III over the shoal section of Table I. When plotting the shoal sections of both tables on graph paper, it was found that at the depth of 1980 fathoms the curves had identical slopes. The corrections corresponding to this depth were 44 fathoms for Table III, and 36.2 for Table I. Table I was thus extended by graphically subtracting 7.8 fathoms, or the difference between 44 fathoms and 36.2 fathoms, from the corresponding values of Table III.

To make sure that the above operation was valid, the deep sections of both Tables I and III were compared with the Admiralty Tables. Table 43 of the Admiralty Tables, corresponding to the area of Table III, agreed with the latter quite well, with the average difference of 2.4 fathoms. Comparing Table 44 of the Admiralty Tables with the corresponding Table I, the agreement was even better, with an average difference of 2.2 fathoms.

Copies of the two tables used for correcting soundings are included in this report. The use of the 130°W meridian, as the line of demarkation between the two, was strictly observed. Soundings taken near this meridian were reduced only after smooth plotting to insure the use of proper corrections. The corresponding sounding volumes have been clearly labelled to indicate which of the correction tables was used.

It may be added that rather than adopting a meridian as a line of demarkation for velocity corrections as per instructions, the use of a NW-SE line may have been more consistent with the physical situation. Changing correction tables across such a line, however, could have been slightly more complicated.

VELOCITY CORRECTIONS -- OPR-454

(Used E of 130°W longitude only)

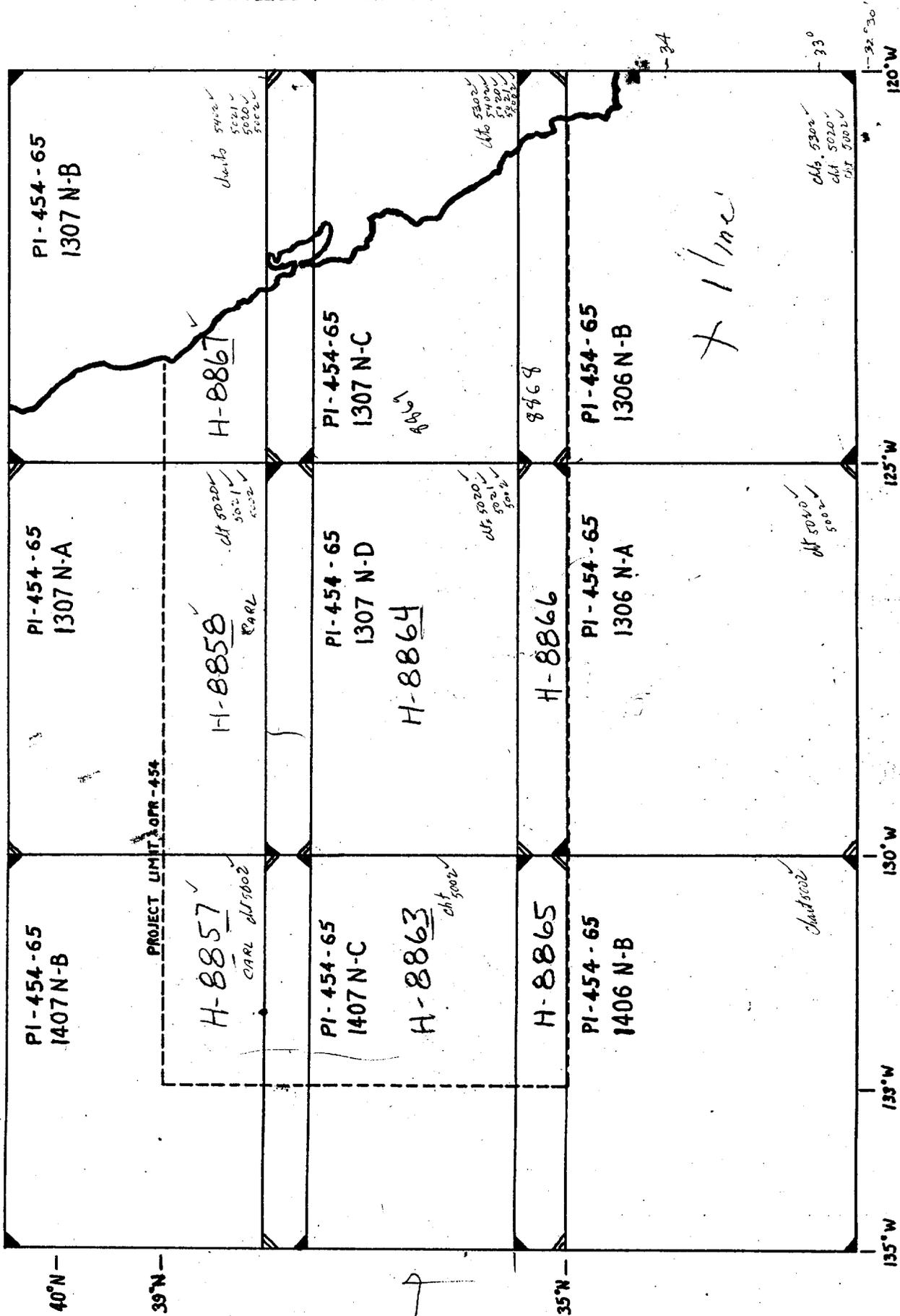
<u>Observed sounding</u> (fathoms)		<u>Corr'n</u> (fathoms)	<u>Observed sounding</u> (fathoms)	<u>Corr'n</u> (fathoms)
0.0-	12.0	+ 0.0	2071 - 2120	+ 42
12.2-	24.5	0.2	2121 - 2165	44
24.6-	37.5	0.4	2166 - 2210	46
37.6-	49.5	0.6	2211 - 2255	48
50.0-	62.0	0.8	2256 - 2300	50
62.5-	74.5	1.0	2301 - 2340	52
75.0-	87.5	1.2	2341 - 2380	54
88.0-	128	1.5	2381 - 2420	56
129 -	173	2	2421 - 2460	58
174 -	330	3	2461 - 2500	60
331 -	430	4	2501 - 2540	62
431 -	530	5	2541 - 2580	64
531 -	620	6	2581 - 2615	66
621 -	850	8	2616 - 2655	68
851 -	990	10	2656 - 2690	70
991 -	1105	12	2691 - 2725	72
1106 -	1205	14	2726 - 2760	74
1206 -	1295	16	2761 - 2795	76
1296 -	1385	18	2796 - 2835	78
1386 -	1465	20	2836 - 2870	80
1466 -	1540	22	2871 - 2905	82
1541 -	1610	24	2906 - 2940	84
1611 -	1675	26	2941 - 2975	86
1676 -	1740	28	2976 - 3010	88
1741 -	1805	30		
1806 -	1865	32		
1866 -	1920	34		
1921 -	1975	36		
1976 -	2025	38		
2026 -	2070	40		

VELOCITY CORRECTIONS -- OPR-454

(Used W of 130°W longitude only)

<u>Observed sounding</u> (fathoms)	<u>Corr'n</u> (fathoms)	<u>Observed sounding</u> (fathoms)	<u>Corr'n</u> (fathoms)
931 - 1055	+ 16	2426 - 2465	+ 66
1056 - 1160	18	2466 - 2505	68
1161 - 1255	20	2506 - 2545	70
1256 - 1345	22	2546 - 2585	72
1346 - 1430	24	2586 - 2620	74
1431 - 1510	26	2621 - 2655	76
1511 - 1580	28	2656 - 2695	78
1581 - 1645	30	2696 - 2730	80
1646 - 1695	32	2731 - 2765	82
1696 - 1740	34	2766 - 2800	84
1741 - 1785	36	2801 - 2840	86
1786 - 1835	38	2841 - 2875	88
1836 - 1885	40	2876 - 2910	90
1886 - 1930	42	2911 - 2945	92
1931 - 1980	44	2946 - 2980	94
1981 - 2025	46	2981 - 3015	96
2026 - 2075	48		
2076 - 2125	50		
2126 - 2170	52		
2171 - 2215	54		
2216 - 2260	56		
2261 - 2305	58		
2306 - 2345	60		
2346 - 2385	62		
2386 - 2425	64		

# SHEET LAYOUT - OPR-454



HYDROGRAPHIC SURVEY STATISTICS  
HYDROGRAPHIC SURVEY NO. 8857-~~58~~  
8857-69

RECORDS ACCOMPANYING SURVEY: To be completed when survey is registered.

RECORD DESCRIPTION		AMOUNT		RECORD DESCRIPTION		AMOUNT	
SMOOTH SHEET				BOAT SHEETS			
DESCRIPTIVE REPORT				OVERLAYS			
DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/ SOURCE DOCUMENTS	
ENVELOPES	2						
CAHIERS							
VOLUMES	3						
BOXES							
T-SHEET PRINTS (List)							
SPECIAL REPORTS (List)							

OFFICE PROCESSING ACTIVITIES

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	

*always* *No verification or review of project will be made in the marine chart Div. J O Boyer 12/70*



**HYDROGRAPHIC SURVEY STATISTICS**  
**HYDROGRAPHIC SURVEY NO. 8858**

**RECORDS ACCOMPANYING SURVEY:** To be completed when survey is registered.

RECORD DESCRIPTION		AMOUNT		RECORD DESCRIPTION		AMOUNT	
SMOOTH SHEET				BOAT SHEETS			
DESCRIPTIVE REPORT				OVERLAYS			
DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/ SOURCE DOCUMENTS	
ENVELOPES	2						
CAHIERS							
VOLUMES	4						
BOXES							
T-SHEET PRINTS ( <i>List</i> )							
SPECIAL REPORTS ( <i>List</i> )							

**OFFICE PROCESSING ACTIVITIES**

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY		BEGINNING DATE		ENDING DATE
VERIFICATION BY		BEGINNING DATE		ENDING DATE
REVIEW BY		BEGINNING DATE		ENDING DATE



**HYDROGRAPHIC SURVEY STATISTICS**  
**HYDROGRAPHIC SURVEY NO. 8863**

**RECORDS ACCOMPANYING SURVEY:** To be completed when survey is registered.

RECORD DESCRIPTION		AMOUNT		RECORD DESCRIPTION		AMOUNT	
SMOOTH SHEET				BOAT SHEETS			
DESCRIPTIVE REPORT				OVERLAYS			
DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/ SOURCE DOCUMENTS	
ENVELOPES	3						
CAHIERS							
VOLUMES	5						
BOXES							
T-SHEET PRINTS ( <i>List</i> )							
SPECIAL REPORTS ( <i>List</i> )							

**OFFICE PROCESSING ACTIVITIES**

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	



**HYDROGRAPHIC SURVEY STATISTICS**  
**HYDROGRAPHIC SURVEY NO. 8864**

**RECORDS ACCOMPANYING SURVEY:** To be completed when survey is registered.

RECORD DESCRIPTION		AMOUNT	RECORD DESCRIPTION		AMOUNT	
SMOOTH SHEET			BOAT SHEETS			
DESCRIPTIVE REPORT			OVERLAYS			
DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/ SOURCE DOCUMENTS
ENVELOPES	3					
CAHIERS						
VOLUMES	6					
BOXES						
T-SHEET PRINTS ( <i>List</i> )						
SPECIAL REPORTS ( <i>List</i> )						

**OFFICE PROCESSING ACTIVITIES**

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	



**HYDROGRAPHIC SURVEY STATISTICS**  
**HYDROGRAPHIC SURVEY NO. 8865**

**RECORDS ACCOMPANYING SURVEY:** To be completed when survey is registered.

RECORD DESCRIPTION	AMOUNT	RECORD DESCRIPTION	AMOUNT
SMOOTH SHEET		BOAT SHEETS	
DESCRIPTIVE REPORT		OVERLAYS	

DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/SOURCE DOCUMENTS
ENVELOPES	3					
CAHIERS						
VOLUMES	3					
BOXES						

T-SHEET PRINTS (*List*)

SPECIAL REPORTS (*List*)

**OFFICE PROCESSING ACTIVITIES**

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	



HYDROGRAPHIC SURVEY STATISTICS  
 HYDROGRAPHIC SURVEY NO. 8866

RECORDS ACCOMPANYING SURVEY: To be completed when survey is registered.

RECORD DESCRIPTION		AMOUNT		RECORD DESCRIPTION		AMOUNT	
SMOOTH SHEET				BOAT SHEETS			
DESCRIPTIVE REPORT				OVERLAYS			
DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/ SOURCE DOCUMENTS	
ENVELOPES	2						
CAHIERS							
VOLUMES	2						
BOXES							
T-SHEET PRINTS (List)							
SPECIAL REPORTS (List)							

OFFICE PROCESSING ACTIVITIES

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	



HYDROGRAPHIC SURVEY STATISTICS  
HYDROGRAPHIC SURVEY NO. 8867

RECORDS ACCOMPANYING SURVEY: To be completed when survey is registered.

RECORD DESCRIPTION		AMOUNT	RECORD DESCRIPTION		AMOUNT	
SMOOTH SHEET			BOAT SHEETS		3	
DESCRIPTIVE REPORT			OVERLAYS			
DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/SOURCE DOCUMENTS
ENVELOPES	2					
CAHIERS						
VOLUMES	2					
BOXES						
T-SHEET PRINTS (List)						
SPECIAL REPORTS (List)						

OFFICE PROCESSING ACTIVITIES

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	



**HYDROGRAPHIC SURVEY STATISTICS**  
**HYDROGRAPHIC SURVEY NO. 8868**

**RECORDS ACCOMPANYING SURVEY:** To be completed when survey is registered.

RECORD DESCRIPTION		AMOUNT	RECORD DESCRIPTION		AMOUNT	
SMOOTH SHEET			BOAT SHEETS			
DESCRIPTIVE REPORT			OVERLAYS			
DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/ SOURCE DOCUMENTS
ENVELOPES	2					
CAHIERS						
VOLUMES	3 3					
BOXES						
T-SHEET PRINTS ( <i>List</i> )						
SPECIAL REPORTS ( <i>List</i> )						

**OFFICE PROCESSING ACTIVITIES**

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	



HYDROGRAPHIC SURVEY STATISTICS  
 HYDROGRAPHIC SURVEY NO. 8869

RECORDS ACCOMPANYING SURVEY: To be completed when survey is registered.

RECORD DESCRIPTION	AMOUNT	RECORD DESCRIPTION	AMOUNT
SMOOTH SHEET		BOAT SHEETS	3
DESCRIPTIVE REPORT		OVERLAYS	

DESCRIPTION	DEPTH RECORDS	HORIZ. CONT. RECORDS	PRINTOUTS	TAPE ROLLS	PUNCHED CARDS	ABSTRACTS/SOURCE DOCUMENTS
ENVELOPES	2					
CAHIERS						
VOLUMES	6	6				
BOXES						

T-SHEET PRINTS (List)

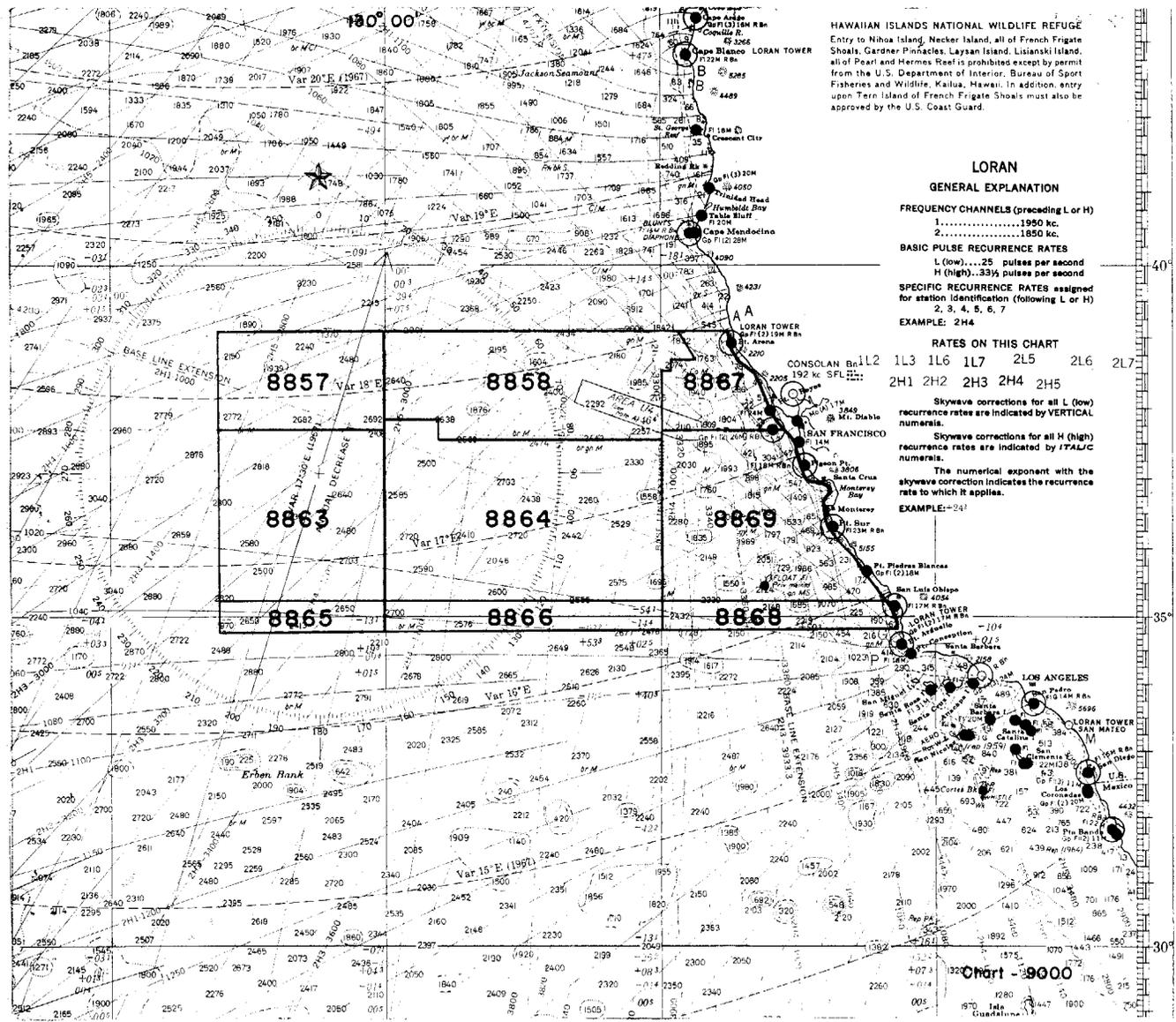
SPECIAL REPORTS (List)

OFFICE PROCESSING ACTIVITIES

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS			
	PRE-VERIFICATION	VERIFICATION	REVIEW	TOTALS
POSITIONS ON SHEET				
POSITIONS CHECKED				
POSITIONS REVISED				
DEPTH SOUNDINGS REVISED				
DEPTH SOUNDINGS ERRONEOUSLY SPACED				
SIGNALS ERRONEOUSLY PLOTTED OR TRANSFERRED				
	TIME (MANHOURS)			
TOPOGRAPHIC DETAILS				
JUNCTIONS				
VERIFICATION OF SOUNDINGS FROM GRAPHIC RECORDS				
SPECIAL ADJUSTMENTS				
ALL OTHER WORK				
<b>TOTALS</b>				
PRE-VERIFICATION BY	BEGINNING DATE		ENDING DATE	
VERIFICATION BY	BEGINNING DATE		ENDING DATE	
REVIEW BY	BEGINNING DATE		ENDING DATE	





HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE  
 Entry to Nihoa Island, Necker Island, all of French Frigate Shoals, Gardner Pinnacles, Laysan Island, Lisianski Island, all of Pearl and Hermes Reef is prohibited except by permit from the U.S. Department of Interior, Bureau of Sport Fisheries and Wildlife, Kailua, Hawaii. In addition, entry upon Tern Island of French Frigate Shoals must also be approved by the U.S. Coast Guard.

**LORAN**

**GENERAL EXPLANATION**

**FREQUENCY CHANNELS** (preceding L or H)  
 1 ..... 1950 kc.  
 2 ..... 1850 kc.

**BASIC PULSE RECURRENCE RATES**  
 L (low)....25 pulses per second  
 H (high)....33½ pulses per second

**SPECIFIC RECURRENCE RATES** assigned for station identification (following L or H)  
 2, 3, 4, 5, 6, 7

EXAMPLE: 2H4

**RATES ON THIS CHART**

1L3 1L6 1L7 2L5 2L6 2L7  
 2H1 2H2 2H3 2H4 2H5

Skywave corrections for all L (low) recurrence rates are indicated by **VERTICAL** numerals.

Skywave corrections for all H (high) recurrence rates are indicated by **ITALIC** numerals.

The numerical exponent with the skywave correction indicates the recurrence rate to which it applies.

EXAMPLE: 247

Chart 19000

Appl'd to 5302 OS ✓ MR } Before V&R  
 " " 5402 OS ✓ MR }  
 " " 5002 OS ✓ MR }  
 " " 5021 OS - MR }  
 " " 5020 OS ✓ MR }

5387 - No corr 4/4/67, OS  
 see page 5 item 'L'

Ch. 9000, Part. Applied before V&R. - 5/9/67 John P. Wein

Ch. 5603 Examined H-8867 before V&R, no correction, consider fully applied 5/14/67 JPW  
 Ch. 5602 Part appl before V&R. 10/11/67 JPW.

Chart 5599 - No corr consider fully appl before V&R 11-10-67 HR (H-8867)  
 NO CORR " " " " " " 11-13-67 HR (H-8867)